IST659 Lab3 Exercise

1. Problem Description

(1) Hierarchical Database Model

You need to use the hierarchical database model to illustrate the structure of a university. One university consists of many schools. For example, a university called "University A" has the following schools - business school, engineering school, life sciences, information technology school. One school consists of many departments. For example, the information technology school has departments such as Information management, Library Information systems, and Telecommunication Network Management. One department offers many courses. To simplify the problem, we assume that one school consists of at least one department, and one department offers at least one course. We also do not consider the situation of courses overlapping between departments or schools. If you make any assumptions in addition to the information provided as above, make sure to list them with your data model.

(2) Supertype and Subtype

The XYZ Bank is a major bank that provides services for different types of customers like company accounts, individual accounts, joint accounts and others. You need to design a simplified Bank Accounts Management System to store the metadata of the account types.

This database should store information about various accounts offered at the bank, including account ID, branch location, balance, etc. The type of an account can be either one of the following saving, checking, and credit or can be a combination of them example: "Checking and Saving", "Credit, checking and saving", etc. Table 1 below shows the information about each type of account.

Account	Information captures
Checking	CheckingAccountID, OverdraftAmount, MinimumBalance
Saving	SavingAccountID, OverdraftAmount, MinimumBalance, SavingInterestRates
Credit	CreditAccountID, CreditlineAmount, InterestRate

(3) Data Normalization

You need to develop a normalized data model starting with a sample document (see table 2 below). The sample document is a Wireless (Mobile) bill summary sheet that the XYZ Company is currently using to track the wireless usage for its customers. The XYZ Company wants to build a database to store and retrieve this information.

XYZ Company follows these business rules:

a. Each account can be held by one and only one customer.
b. Each account will have voice, text and a data plan.

c. Each PlanId of Voice, Text and Data is different from each other
d. Each PlanId (Voice, Text, Data) is associated with one or more account number.

e. Total utility bill amount is the summation of Voice, Text and Data amounts for the billing period. There are no adjustments from previous cycles.

Table 2 XYZ Company Wireless Bill Summary Sheet

XYZ Wireless Services Company
Wireless Bill Summary

Section A: Customer Information

Customer ID # _____ First Name_____ Last Name _____
Address_____ Phone # _____

Section B: Account Information
Account # _____ Account Type_____ (Postpaid or Prepaid)

Billing Period: Start Date _____ End Date _____ Due Date_____
Last Payment Amount _____ Last Payment Date _____

Section C: Usage Information

Voice:
PlanID # _____Minutes _____ Per Minute Charge _____ Amount _____

Data:
PlanID# _____MB used _____ Per MB Charge _____ Amount _____

Text:
PlanID# _____No of Texts _____ Per Text Message Charge _____ Amount ____

Total Wireless Bill Amount _____

2. Instruction

For questions (1) and (2), create two ERDs according to the following instructions:

(1) Create necessary entities, and give appropriate names to them.
(2) Add entity attributes. Make sure their attributes are at atomic level using good naming conventions (no composite attribute, no multi-value attribute).
(3) Set up primary key for each entity.
(4) Establish relationships between entities. Give the relationships appropriate names (show forward verb phrases only) and recognize the associations (foreign keys).
(5) Mark correct cardinality of the relationships.

For question (3), you will begin with identifying the functional dependencies and then move forward with normalizing this data model to the 1NF (first normal form), 2NF (second normal form) and 3NF (third normal form). Make sure you also demonstrate the intermediate steps before arriving at the 3NF i.e. show 1NF and 2NF ERDs and written explanations for the functional dependencies. Your final ERD must be in the 3NF, which means, there should be no multi-valued attributes, partial dependencies or transitive dependencies in the model.

Note: feel free to create new entities or attributes when necessary.

Here is the list of all items that you should turn in and their point distribution:

(1) A list of all functional dependencies
(2) The data model that conforms to 1NF
(3) Explanation of what you did to normalize the current table to 1NF
(4) The data model that conforms to 2NF
(5) Explanation of what partial dependencies you have found and how you removed them
(6) The data model that conforms to 3NF
(7) Explanation of what transitive dependencies you have found and how you removed them

3. Submission Instruction

Please submit your report (including the ERD and screenshots to the questions) in one Word file to the assignment page in BlackBoard. You can copy and paste your Visio ERD directly to MS Word file. Name your file in this format "IST659-Lab3-Lastname-Firstname.doc". Please also bring a paper copy to class. It's easier to mark and comment on data models on paper.

4. Due Date

The lab report is due on Tuesday, 02/16, 02:00pm. The instructor and TA usually set aside a chunk of time to grade the reports. Late submissions would prolong the grading process. To ensure fast feedback, please turn in your report on time. If you cannot finish your homework on time for some reason, please turn in the unfinished work and explain your situation.

5. Grading Rubrics

This lab evaluates students' understanding of the hierarchical database model, supertype and subtype, and data normalization. The grading is based on the assessment whether the students have grasped these key concepts.

5 points – all concepts correctly understood, all answers correct
4.5 points – confusion about a key concept, sometimes right
4 points – one key concept obviously misunderstood
3.5 points – confusion about a couple concepts, sometimes right
3 points – two key concepts obviously misunderstood
2 points or below – basically don't understand these concepts